Commentary

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Biomarkers: A Crucial Factor in Pesticide Toxicology

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Description

Biomonitoring is the standardization of analytical procedures for the diagnostic evaluation of biological materials in order to determine if a subject's health has been harmed by pesticide, hazardous chemical, or intoxication. Furthermore, pesticides, their metabolites or reaction products in blood or blood components, urine, and exhaled carbon dioxide hair or nails and tissues might be classified as biomarkers. Biomarkers are quantifiable indications of diseased or toxic symptoms, pathogenic processes, or pharmacological reactions to xenobiotics. These are used to measure and assess normal biological and pathological processes, as well as pharmacologic reactions, in order to monitor and estimate population health status and implement appropriate treatment interventions.

A single or a group of biomarkers can be used to determine an individual's health or diseased condition, and each biological system has its own set of biomarkers. The majority of these biomarkers is safe and simple to analyze, as well as cost-effective and consistent across gender and ethnic groups, and are used in routine medical checkups. These are used to predict severe diseases including diabetes, heart disease, and stroke, neurological disorders, etc. Biomarkers provide a clear picture of a person's health and suggest whether or not a diagnosis is required. A biomarker can also be a component that is used to monitor its path in order to study organ function or other aspects of health. It comprises a wide variety of medical indications and symptoms, from in vitro methods to molecular imaging and genetic abnormalities, all of which can be used.

Blood, bodily fluids, or tissue that reflects an abnormal process or disease condition is examples of measurable indications. Biomarkers are categorized into two kinds.

- Biomarkers of exposure, which can predict risk and are related to measurement techniques and the substance's toxic kinetics, and
- Biomarkers of effect, which include a variety of measurements such as assays on blood and liver, tissues, and provide information about the nature of the effect under investigation. The discovery of different biomarkers associated with a functional organ or system.

Saliva has been used to evaluate a number of biomarkers, medicines, and environmental pollutants and can be utilized as a matrix for pesticide assessment. It represents a simple and easily available fluid that may be used as a biomarker; however it is based on the chemical's pharmacokinetics. Although saliva has been used as a biomarker in studies, the results show that the amounts of pesticide in saliva are much lower than those found in blood and urine. As a result, the presence of pesticide concentrations in saliva may indicate their availability in the organ or tissue, which is useful for biomonitoring.

Acetylcholinesterase (AChE), an enzyme involved in the degradation of acetylcholine, is a key biomarker for pesticide toxicity, particularly organophosphate poisoning. Organophosphate-induced toxicity has been linked to changes in erythrocyte AChE and serum Butyrylcholinesterase (BChE). Organophosphate chemicals have been linked to the phosphorylation-mediated inhibition of AChE activity. AChE is mostly found in the brain, although it is also found in the membranes of red blood cells, whereas BCHE is produced in the liver and is found in serum.

Conclusion

In comparison to blood, urine is the most often utilized biomarker for pesticide exposure and toxicity monitoring. It is the ease of sample collection due to the high concentration of metabolites and their abundance in the analysis. In some situations, such as with newborns and young children, collecting a urine sample requires extra care. Water consumption, urea, salts, specific gravity, and osmolarity are some of the variables that influence daily urine outputs.